CLAIMS

What is claimed is:

1. A differential system comprising:

a case defining an interior cavity, said case having a bore communicating with said interior cavity;

a pair of pinion gears positioned within said interior cavity and rotatably coupled to said case;

first and second side gears positioned within said interior cavity in meshing engagement with said pinion gears and rotatably coupled to said case; and

an electromagnetic actuator having a coil moveable within said bore between an engaged position and a disengaged position, said case being drivingly coupled to said first side gear when said coil is in said engaged position.

2. The differential system of claim 1 wherein said electromagnetic actuator includes an axially slidable ring coupled to said coil, said ring being selectively engageable with said first side gear.

3. The differential system of claim 2 wherein said ring includes a plurality of dogs that are selectively engageable with a plurality of dogs extending from said first side gear.

4. The differential system of claim 3 wherein said case includes a removable cap, said cap including a recess within which a portion of said electromagnetic actuator is positioned.

5. The differential system of claim 4 further including a spring biasing said ring toward a position disengaged from said first side gear.

6. The differential system of claim 5 wherein said pinion gears rotate about a first common axis and wherein said first and second side gears rotate about a second common axis, said first common axis being positioned substantially orthogonal to said second common axis.

7. The differential system of claim 6 further including a first shaft drivingly coupled to said first side gear and a second shaft drivingly coupled to said second side gear.

8. The differential system of claim 5 wherein said pinion gears rotate about axes parallel to and offset from one another.

9. The differential system of claim 4 further including a non-ferromagnetic spacer positioned between said cap and said ring.

10. A differential system comprising:

a rotatable case defining an interior cavity;

a pair of pinion gears rotatably supported in said interior cavity;

a pair of side gears rotatably supported in said interior cavity, wherein each of said pinion gears drivingly engages each of said side gears; and

an electrically operable coupling including a moveable electromagnet, said coupling operable for selectively interconnecting one of said side gears to said case in response to movement of said electromagnet.

11. The differential system of claim 10 further including a controller in communication with said coupling to selectively operate said coupling in response to a vehicle signal.

12. The differential system of claim 11 wherein said vehicle signal is one of the group consisting of a wheel speed, a wheel speed differential, a transfer case range position, a gear position, a vehicle speed, a brake application or a change in wheel speed.

13. The differential system of claim 12 further including a ring selectively engageable with said one of said side gears, said ring being rotationally retained by said case and axially moveable relative to said case.

14. The differential system of claim 13 further including a spring biasing said ring toward a position disengaged from said first side gear.

15. A method of transitioning between modes of differentiation between rotating shafts in a differential having a case and a side gear, the method comprising the steps of:

measuring a vehicle parameter;

determining a mode of differentiation;

selectively providing an electrical signal to an electromagnet based on said determination;

generating a magnetic field;

axially translating said electromagnet; and

selectively drivingly interconnecting the side gear and the case in response to axial translation of said electromagnet.

16. The method of claim 15 wherein the modes of differentiation include open and locked.

17. The method of claim 16 wherein the step of measuring a vehicle parameter includes calculating a differential speed between said first shaft and a second shaft.

18. The method of claim 17 wherein the step of measuring a vehicle parameter includes receiving a signal indicating that a brake of a vehicle is being applied.

19. The method of claim 15 wherein said vehicle parameter is selected from the group consisting of a wheel speed, a vehicle speed, a gear position, a transfer case range position, application of one or more vehicle brakes and a differential speed between shafts.

20. The method of claim 15 further including selectively engaging a ring with the side gear, said ring being fixed to said electromagnet and slidably positioned within a pocket of the case.

21. The method of claim 20 wherein said ring includes a plurality of axially extending dogs selectively engageable with a plurality of dogs extending from the side gear.